STATE OF CONNECTICUT

SITING COUNCIL

Re:	The Connecticut Light and Power Company and The United Illuminating Company Application for a Certificate of Environmental Compatibility and Public Need for the Construction of a New 345-kV Electric Transmission Line and Associated Facilities Between Scovill Rock Switching Station in Middletown and Norwalk Substation in Norwalk, Connecticut Including the Reconstruction of Portions of Existing 115-kV and 345-kV Electric Transmission Lines, the Construction of the Beseck Switching Station in Wallingford, East Devon Substation in Milford, and Singer Substation in Bridgeport, Modifications at Scovill Rock Switching Station and Norwalk Substation and the Reconfiguration of Certain Interconnections	)	Docket 272 April 30, 2004

SUPPLEMENTAL TESTIMONY OF DR. WILLIAM H. BAILEY
CONCERNING SITE-SPECIFIC DESIGNS TO REDUCE 60-HZ ELECTRIC AND MAGNETIC FIELDS AT THE B'NAI JACOB/EZRA ACADEMY AND THE JEWISH COMMUNITY CENTER IN WOODBRIDGE, CONNECTICUT

Q. Dr. Bailey, in the March 25th hearing the mutual cancellation of magnetic fields from adjacent conductors (on the same or different structures) was discussed. In the course of that discussion you mentioned that The Connecticut Light and Power Company ("CL&P") and The United Illuminating Company ("UI") were working on considering site-specific designs to maximize this mutual cancellation. At that time, Chairman Katz asked that you tell us something more definitive about these efforts. Why were site-specific designs being studied?

A. CL&P and UI (the "Companies") wanted to address the concerns of parents of children who attend B'nai Jacob/Ezra Academy and The Jewish Community Center of Greater New Haven in Woodbridge, Connecticut had about electric and magnetic fields (EMF). The Companies wanted to know whether site-specific design changes to the proposed line at these locations could reduce magnetic field levels at nearby buildings.

Q. Is this effort is consistent with the Siting Council's EMF Best Management Practices?

A. Yes. This effort is consistent with the recommendation in my pre-filed testimony that the Siting Council's EMF Best Management Practices include more site-specific planning to reduce magnetic fields as a way of responding to public concern.

EVALUATION OF SITE-SPECIFIC TRANSMISSION DESIGNS AT B'NAI JACOB/EZRA ACADEMY AND THE JEWISH COMMUNITY CENTER

Q. Are you familiar with the Companies' research on these designs and how they could be applied to sections of the proposed route that pass the B'nai Jacob/Ezra Academy and the Jewish Community Center in Woodbridge, Connecticut?

A. Yes, my colleague, Dr. Gary Johnson, and I have been working with the Companies since January of this year to identify ways to modify the design of the proposed 345-kV line at these locations so that when installed next to the two reconstructed 115-kV transmission lines, the mutual cancellation of fields from all conductors would cause the field levels to be similar to or lower than those produced by the existing lines at the buildings adjacent to the right-of-way.

Q. And, were your efforts successful?

A. Yes. We have provided a conceptual design to the Companies that will result in field levels at the buildings that are similar or lower than those produced by the existing lines. To accomplish this, the conductors of the proposed line would be configured in a 'split-phase' arrangement.

Q. Please describe the process by which you evaluated potential designs.

A. Certainly. We began by evaluating how factors known to affect the levels of EMF from transmission lines might be applied at these sites to reduce EMF. As each factor was incorporated into the design, its effect on field levels was compared to the field levels produced by the existing 115 kV transmission lines for system loads of 15 GW (average) and 27 GW (peak).

The first factor we examined is distance. Moving the proposed line further away from B'nai Jacob/Ezra Academy reduced field levels there. At the Jewish Community Center, however, there was not enough right-of-way to move the proposed line further away in order to reduce the magnetic field. We then examined the effect of raising the height of the conductors of both the existing and proposed transmission lines by 10 ft, and then by another 10 ft. To obtain still further field reductions we evaluated the effect of changing the configuration of the conductors from a delta to a vertical orientation. To maximize the mutual cancellation between the conductors in the vertical configuration and the existing 115-kV lines, we studied what phasing arrangements would result in the lowest field levels. The combination of relocation, vertical configuration, and phasing adjustment reduces the magnetic and electric fields at B'nai Jacob/Ezra Academy below existing field levels.

At the Jewish Community Center, the vertical configuration and phasing adjustments alone, without relocation, reduce field levels but were less effective. Therefore, we continued evaluating other potential designs and finally developed a split-phase configuration that, together with selection of optimal conductor phasing, resulted in magnetic field levels at the closest building edge that were lower (15 GW loading) or similar to (27 GW loading) field levels associated with the operation of the existing 115-kV lines.

Q. Why does the split-phase design result in lower EMF than the delta or vertical conductor configurations?

A. Instead of the proposed steel pole supporting three conductors in a delta configuration as illustrated in Cross Section 8 in the Application (Exhibit 1), the new design calls for the placement of three additional conductors on the structure so that it appears as if it were a double-circuit structure in a vertical configuration (Exhibit 2). The current on the proposed 345-kV circuit would now divide equally among six conductors instead of three and we have arranged the phasing of the three conductors on one side of the tower to produce maximal cancellation of the fields from the three conductors on the other side of the tower. Hence, the split-phase design results in lower fields because the currents on each conductor are lower and the efficiency of cancellation of fields is increased.

Q. Has this design been considered previously by the Connecticut Siting Council as a means of reducing EMF?

A. No. To my knowledge this design is new in Connecticut and it was not among the designs for overhead lines evaluated in the report "Life-Cycle Cost Studies for Overhead and Underground Electric Transmission Lines" prepared for the Council by Acres International Corporation in 1996.

THE SPLIT-PHASE DESIGN RESULTS IN MAGNETIC FIELD LEVELS THAT ARE LOWER OR SIMILAR TO THOSE ASSOCIATED WITH EXISTING TRANSMISSION LINES

B'nai Jacob/Ezra Academy

Q. Please describe the orientation of the transmission right-of-way to B'nai Jacob/Ezra Academy.

A. Exhibit 3 is an aerial photo of the B'nai Jacob/Ezra Academy complex on which the existing right-of-way is shown by yellow lines. The red lines show a relocated right-of-way designed to move the line as far as possible from the complex on existing B'nai Jacob/Ezra Academy property. The longest section of right-of-way oriented diagonally across the photo is referenced as the North ROW; the portion of the right-of-way extending horizontally across the photo is referenced as the West ROW.

Q. Please summarize the calculated EMF levels for the various designs you evaluated at the edge of the North right-of-way nearest to the B'nai Jacob/Ezra Academy and at the nearest building edge.

A. In Exhibit 4, the effects of various design scenarios on the North right-of-way are compared at a system average loading of 15 GW. Row 1 in the table shows the EMF field levels associated with the existing H-frame 115-kV lines. Row 2 shows the EMF levels associated with the reconfigured existing 115-kV lines with the proposed 345-kV line in a delta configuration in the existing right-of-way. Both these configurations were described in the Application.[1] Row 3 shows the field reduction achieved at the building complex by relocation of the existing and proposed lines further away from the complex. Rows 4 and 5 show the marginal reduction achieved by increasing the height of all conductors by 10 or 20 ft, respectively. Row 6 shows that changing the configuration of the proposed 345-kV line from a delta configuration to a vertical configuration results in a larger reduction in field levels.

The greatest reductions in field levels occur with the split-phase design on the relocated right-of-way (Row 7). With this design, the projected magnetic field level at the nearest edge of the building is 0.1 milligauss (mG), which is lower than the 1.6 mG value associated with the operation of the existing 115-kV transmission lines alone. At a higher system peak load level of 27 GW, which might occur for a few hours over the course of a year, during the highest peak load demand in the summer, the ranking of the design options is unchanged and the split-phase design also reduces the magnetic field by a large percentage (Exhibit 5).

Q. Does the split-phase design also reduce the projected magnetic field from the proposed 345-kV line at the B'nai Jacob/Ezra Academy complex below that associated with the existing transmission lines, even if the right-of-way is not relocated?

A. Yes. Relocation of the proposed split-phase design is not necessary to reduce the magnetic field below that of the existing transmission lines at the nearest edge of the building under both 15 GW (Exhibit 6) and 27 GW (Exhibit 7) loading conditions as shown in Row 6 of these tables.

Q. If the split-phase design were constructed on the West right-of-way would it also reduce the magnetic field below that of the existing transmission lines at the nearest edge of the building?

A. The West right-of-way is much further away from the nearest edge of the building than the North right-of-way so the difference in field levels is very small. The projected

[1] Note that the values at the edge of the right-of-way calculated in the exhibits for the existing and proposed conditions differ from the updated values for Cross Section 8 submitted to the Council on March 15, 2004 because of site-specific factors, including conductor heights and current flows.

magnetic field levels at the building are 0.1 mG for both existing and split-phase designs at 15 GW system loading (Row 7, Exhibit 8) and the split-phase design is projected as reducing the magnetic field by 0.1 mG below that produced by the existing line at a 27 GW system loading (Row 7, Exhibit 9).

The Jewish Community Center

Q. Please describe the orientation of the transmission right-of-way to the Jewish Community Center.

A. Exhibit 10 is an aerial photo of the Jewish Community Center on which the existing right-of-way is shown by yellow lines.

Q. Please summarize the calculated EMF levels for the various designs you evaluated at the edge of the right-of-way nearest to the Jewish Community Center and at the nearest building edge.

A. In Exhibit 11, various design scenarios are compared at a system loading of 15 GW as at B'nai Jacob/Ezra Academy. Again, the greatest reduction in field levels was found for the split-phase design (Row 6). With this design the projected magnetic field level at the nearest edge of the building is 0.5 milligauss (mG), which is lower than the 1.4 mG value associated with the operation of the existing 115-kV transmission lines alone. At a higher system load level of 27 GW (projected to occur no sooner than 2007), which might occur for a few hours over the course of a year, during the highest peak load demand in the summer, the split-phase design has mixed effects on magnetic field levels with a marginal decrease at the edge of the right-of-way and a marginal increase at the nearest building edge (Exhibit 12).

Split-Phase Effects Common To B'nai Jacob /Ezra Academy and The Jewish Community Center

Q. With the split-phase design for the proposed 345-kV line, how do the magnetic fields calculated at the B'nai Jacob/Ezra Academy and the Jewish Community Center buildings compare to magnetic field levels in a typical home?

A. The fields at the nearest edge of the buildings would be less than or the same as the average magnetic field in U.S. homes. The average magnetic field in homes is 0.9 mG (Zaffanella, 1993). At system average loadings, the magnetic field at the nearest edge of B'nai Jacob/Ezra Academy would be 0.1 mG (lines in relocated right-of-way) or 0.9 mG (lines in existing right-of-way). At the Jewish Community Center the comparable magnetic field would be 0.5 mG.

Q. Does the split-phase design also reduce the electric field levels at the nearest edges of the B'nai Jacob/Ezra Academy and the Jewish Community Center buildings?

A. Yes. The split-phase design lowers the electric field levels at these locations below those produced by the existing 115-kV transmission lines at the north side of the B'nai Jacob/Ezra Academy and at the Jewish Community Center. At the west side of the B'nai Jacob/Ezra Academy the projected electric fields are marginally (0.04 kV/m) higher with the split-phase design than the existing transmission lines.

Q. You have described the configurations of the proposed 345-kV line that would result in generally lower electric and magnetic fields at the B'nai Jacob/Ezra Academy and the Jewish Community Center. Have you checked with engineers at CL&P and UI to confirm that all of the proposed designs described in this testimony could be constructed at these locations and would meet other applicable design specifications?

A. Yes, they have reviewed our conceptual designs and assured us that the proposed designs could be constructed and would meet applicable design criteria.

Q. Does this conclude your testimony?

A. Yes. I would be happy to provide a short summary of the proposed design at the upcoming Siting Council hearings.

LIST OF EXHIBITS

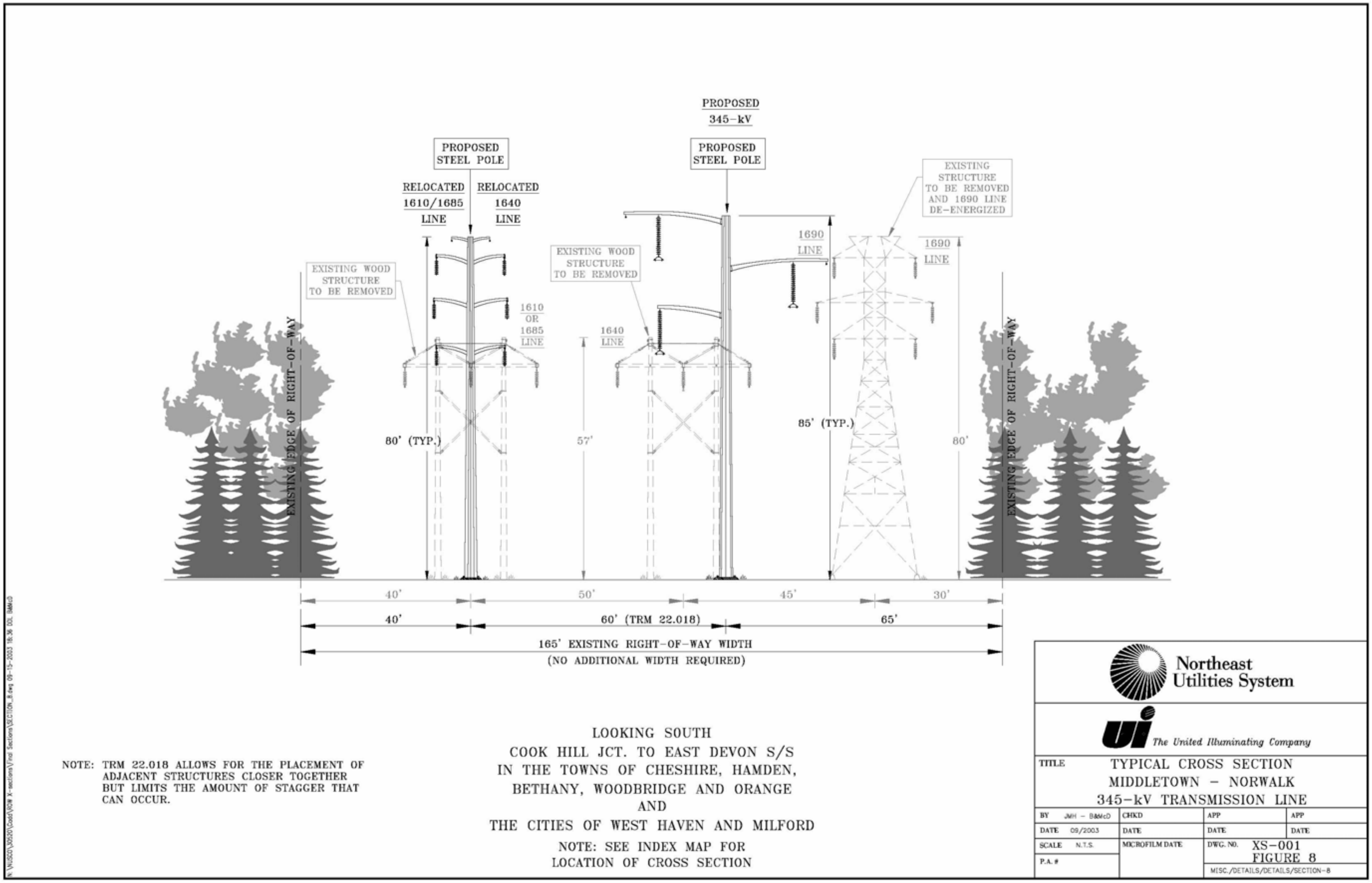

Exhibit 1. Cross Section 8 from the Application. Reconfigured 115-kV circuits at the left and proposed 345-kV circuit in delta configuration at the right.

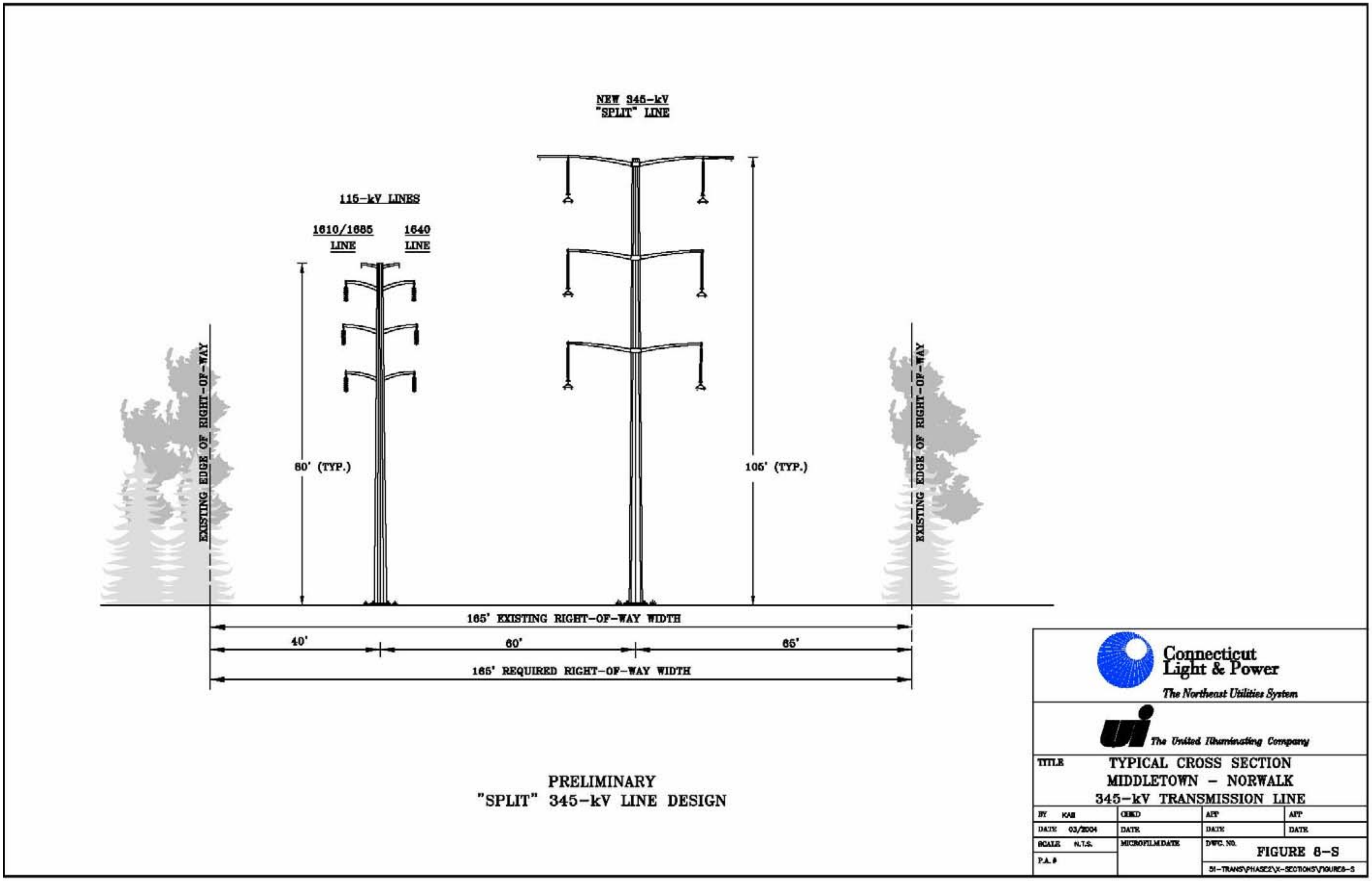

Exhibit 2. Reconfigured 115-kV circuits at the left and proposed 345-kV circuit in split-phase configuration at the right.

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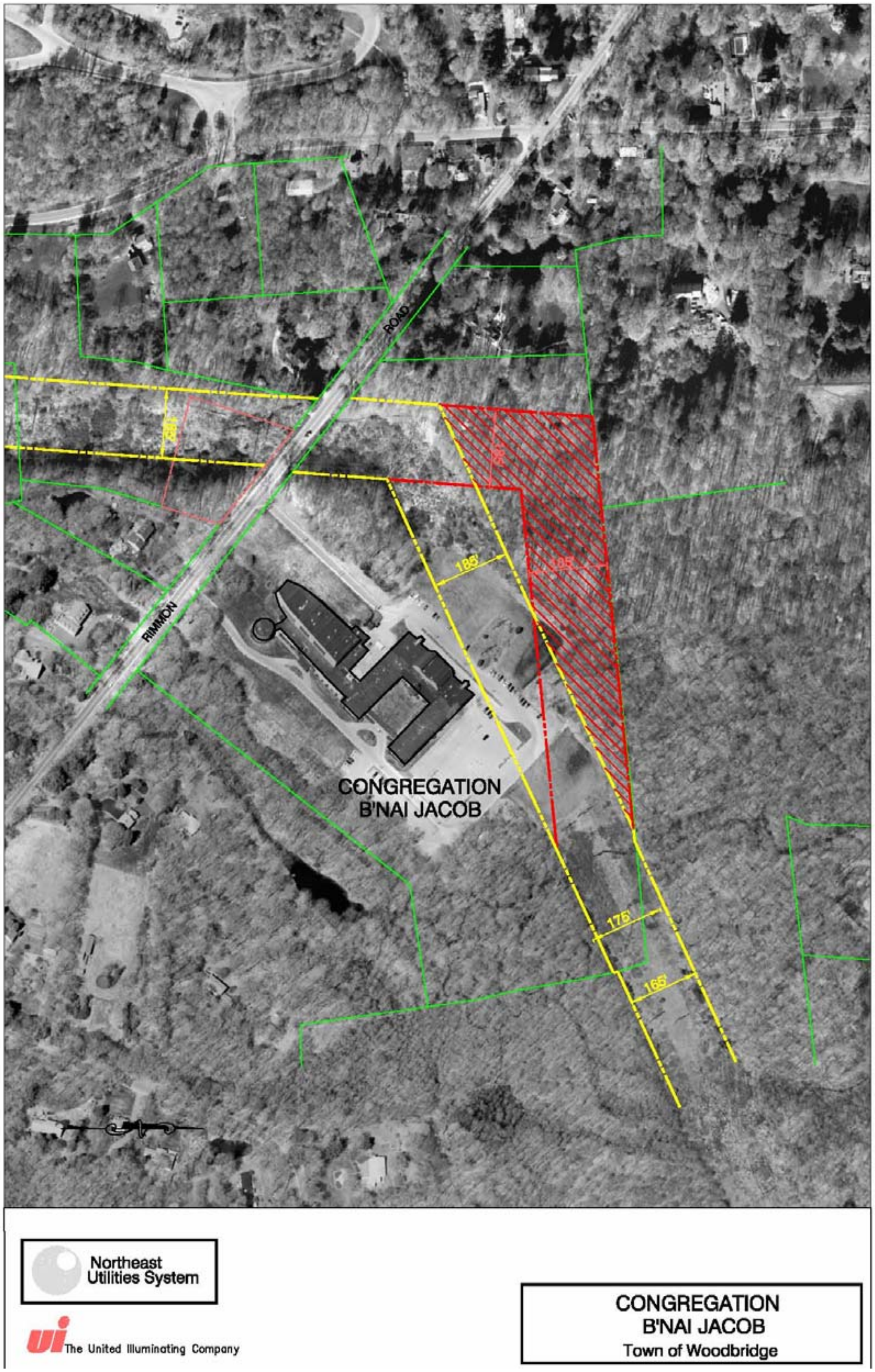

Exhibit 3. B’nai Jacob/Ezra Academy Complex

Exhibit 4. B’nai Jacob/Ezra Academy – North ROW: 15GW Case *(with relocated ROW)*

ROW	Site Condition	ROW Edge (0’)		Building Edge (-15’)		Typical Structure Height (ft)	
		(mG)	(kV/m)	(mG)	(kV/m)	115 kV	345 kV
1	Existing Lines (For Reference)	2.6	0.46	1.6	0.26	57’ 57’ 80’	- - -
2	Proposed Lines on Existing ROW (For Reference)	9.4	0.23	7.3	0.12	80’	85’
3	Proposed Lines on Relocated ROW	9.3	0.24	1.5	0.02	80’	85’
4	Proposed Lines on Relocated ROW	8.3	0.31	1.4	0.02	90’	95’
5	Proposed Lines on Relocated ROW	7.4	0.31	1.4	0.03	100’	105’
6	Proposed Lines on Relocated ROW 345kV Vertical Line	4.1	0.36	1.0	0.12	80’	105’
7	Proposed Lines on Relocated ROW 345kV Split-Phase Line	1.3	0.11	0.1	0.08	80’	105’

Exhibit 5. B’nai Jacob/Ezra Academy – North ROW: 27GW Case *(with relocated ROW)*

ROW	Site Condition	ROW Edge (0’)		Building Edge (-15’)		Typical Structure Height (ft)	
		(mG)	(kV/m)	(mG)	(kV/m)	115 kV	345 kV
1	Existing Lines (For Reference)	10.8	0.47	6.4	0.26	57’ 57’ 80’	- - -
2	Proposed Lines on Existing ROW (For Reference)	25.9	0.22	20.7	0.11	80’	85’
3	Proposed Lines on Relocated ROW	25.7	0.23	4.6	0.02	80’	85’
4	Proposed Lines on Relocated ROW	23.9	0.30	4.5	0.02	90’	95’
5	Proposed Lines on Relocated ROW	22.0	0.31	4.4	0.02	100’	105’
6	Proposed Lines on Relocated ROW 345kV Vertical Line	20.0	0.38	4.3	0.12	80’	105’
7	Proposed Lines on Relocated ROW 345kV Split-Phase Line	6.8	0.12	0.6	0.08	80’	105’

Exhibit 6. B’nai Jacob/Ezra Academy – North ROW: 15GW Case *(remain in existing ROW location)*

ROW	Site Condition	ROW Edge (0’)		Building Edge (-15’)		Typical Structure Height (ft)	
		(mG)	(kV/m)	(mG)	(kV/m)	115 kV	345 kV
1	Existing Lines (For Reference)	2.6	0.46	1.6	0.26	57’ 57’ 80’	- - -
2	Proposed Lines on Existing ROW (For Reference)	9.4	0.23	7.3	0.12	80’	85’
3	Proposed Lines on Existing ROW	8.4	0.30	6.7	0.16	90’	95’
4	Proposed Lines on Existing ROW	7.5	0.32	6.2	0.19	100’	105’
5	Proposed Lines on Existing ROW 345kV Vertical Line	4.1	0.38	3.5	0.36	80’	105’
6	Proposed Lines on Existing ROW 345kV Split-Phase Line	1.3	0.12	0.9	0.21	80’	105’

Exhibit 7. B’nai Jacob/Ezra Academy – North ROW: 27GW Case *(remain in existing ROW location)*

ROW	Site Condition	ROW Edge (0’)		Building Edge (-15’)		Typical Structure Height (ft)	
		(mG)	(kV/m)	(mG)	(kV/m)	115 kV	345 kV
1	Existing Lines (For Reference)	10.8	0.47	6.4	0.26	57’ 57’ 80’	- - -
2	Proposed Lines on Existing ROW (For Reference)	25.9	0.22	20.7	0.11	80’	85’
3	Proposed Lines on Existing ROW	24.1	0.30	19.5	0.16	90’	95’
4	Proposed Lines on Existing ROW	22.2	0.31	18.2	0.19	100’	105’
5	Proposed Lines on Existing ROW 345kV Vertical Line	20.1	0.39	16.6	0.37	80’	105’
6	Proposed Lines on Existing ROW 345kV Split-Phase Line	6.8	0.13	5.0	0.23	80’	105’

Exhibit 8. B'nai Jacob/Ezra Academy – West ROW: 15GW Case

ROW	Site Condition	ROW Edge (0')		Building Edge (-250')		Typical Structure Height (ft)	
		(mG)	(kV/m)	(mG)	(kV/m)	115 kV	345 kV
1	Existing Lines (For Reference)	2.4	0.44	0.1	0.01	57' 57' 80'	- - -
2	Proposed Lines on Existing ROW (For Reference)	8.9	0.28	0.8	0.01	80'	85'
3	Proposed Lines on Relocated ROW*	8.7	0.24	0.8	0.02	80'	85'
4	Proposed Lines on Relocated ROW	7.6	0.31	0.8	0.02	90'	95'
5	Proposed Lines on Relocated ROW	6.7	0.33	0.8	0.02	100'	105'
6	Proposed Lines on Relocated ROW 345kV Vertical Line	3.8	0.32	0.7	0.08	80'	105'
7	Proposed Lines on Relocated ROW 345kV Split-Phase Line	1.5	0.38	0.1	0.05	80'	105'

Exhibit 9. B'nai Jacob/Ezra Academy – West ROW: 27GW Case

ROW	Site Condition	ROW Edge (0')		Building Edge (-250')		Typical Structure Height (ft)	
		(mG)	(kV/m)	(mG)	(kV/m)	115 kV	345 kV
1	Existing Lines (For Reference)	9.8	0.45	0.4	0.01	57' 57' 80'	- - -
2	Proposed Lines on Existing ROW (For Reference)	24.8	0.27	2.7	0.01	80'	85'
3	Proposed Lines on Relocated ROW*	23.1	0.22	2.6	0.02	80'	85'
4	Proposed Lines on Relocated ROW	21.1	0.30	2.6	0.02	90'	95'
5	Proposed Lines on Relocated ROW	19.3	0.33	2.6	0.02	100'	105'
6	Proposed Lines on Relocated ROW 345kV Vertical Line	20.7	0.35	2.7	0.08	80'	105'
7	Proposed Lines on Relocated ROW 345kV Split-Phase Line	6.2	0.37	0.3	0.05	80'	105'

* The differences in the calculated values in Rows 2 and 3 occur because of differences in conductor height that result from the relocation of circuits on the north right-of-way.

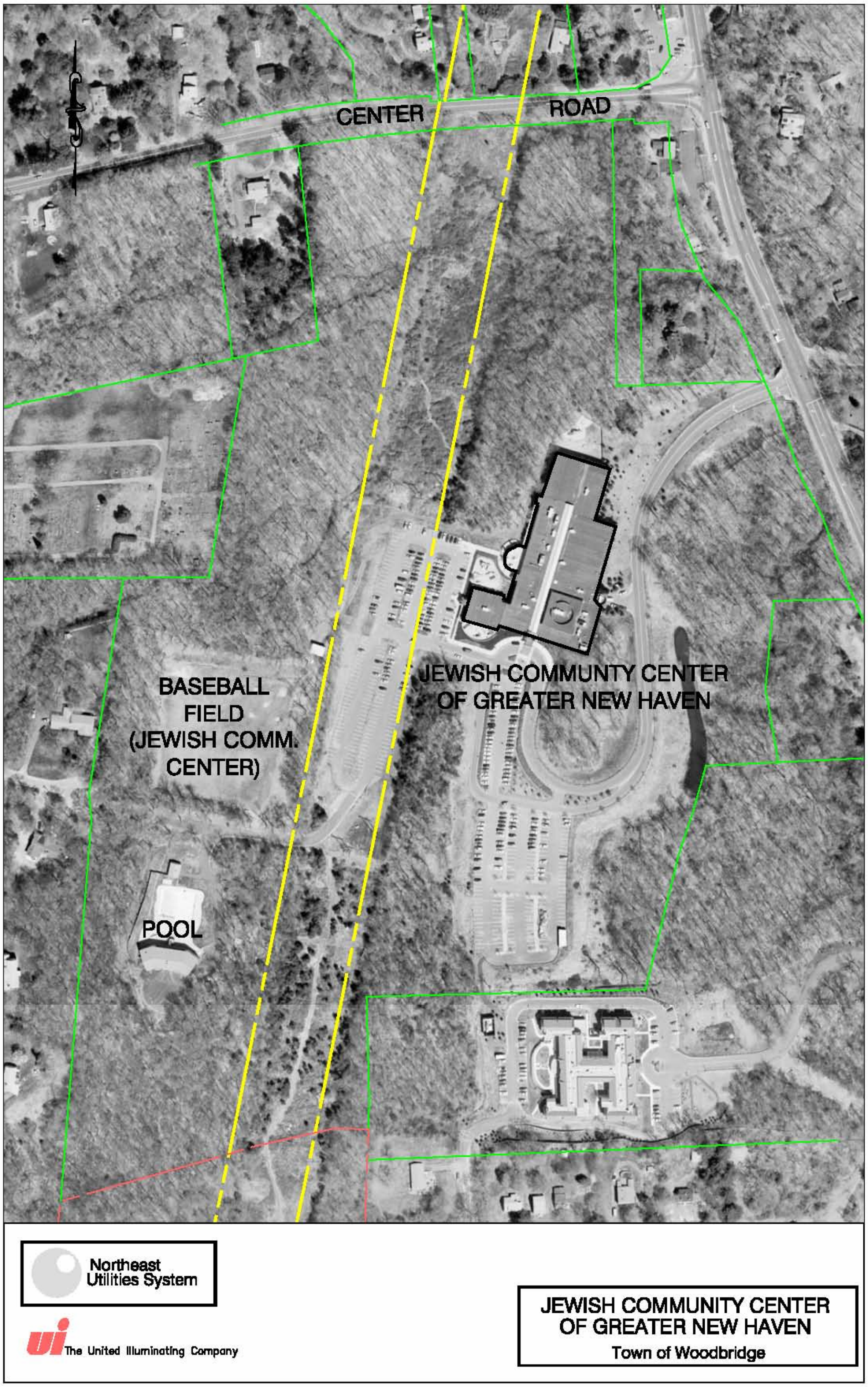

Exhibit 10. The Jewish Community Center of Greater New Haven

Exhibit 11. Jewish Community Center: 15GW Case

ROW	Site Condition	ROW Edge (0')		Building Edge (-60')		Typical Structure Height (ft)	
		(mG)	(kV/m)	(mG)	(kV/m)	115 kV	345 kV
1	Existing Lines (For Reference)	5.0	0.54	1.4	0.09	57' 57' 80'	- - -
2	Proposed Lines (For Reference)	8.5	0.47	3.3	0.06	80'	85'
3	Proposed Lines	7.8	0.46	3.2	0.07	90'	95'
4	Proposed Lines	7.1	0.41	3.1	0.08	100'	105'
5	Proposed Lines 345kV Vertical Line	8.3	0.20	3.8	0.27	80'	105'
6	Proposed Lines 345kV Split-Phase Line	2.3	0.40	0.5	0.08	80'	105'

Exhibit 12. Jewish Community Center: 27GW Case

ROW	Site Condition	ROW Edge (0')		Building Edge (-60')		Typical Structure Height (ft)	
		(mG)	(kV/m)	(mG)	(kV/m)	115 kV	345 kV
1	Existing Lines (For Reference)	13.8	0.60	2.7	0.09	57' 57' 80'	- - -
2	Proposed Lines (For Reference)	29.0	0.46	11.1	0.06	80'	85'
3	Proposed Lines	27.0	0.47	10.8	0.07	90'	95'
4	Proposed Lines	24.6	0.42	10.5	0.08	100'	105'
5	Proposed Lines 345kV Vertical Line	32.8	0.24	14.5	0.28	80'	105'
6	Proposed Lines 345kV Split-Phase Line	12.2	0.38	3.0	0.08	80'	105'